Agilent U7232A DisplayPort Electrical Performance Validation and Compliance Software for Infiniium Series Oscilloscopes

Data Sheet

Verify and debug your DisplayPort designs more easily

Agilent Technologies U7232A DisplayPort electrical performance validation and compliance software for Infiniium Series oscilloscopes (see Table 1) provides you with a fast and easy way to verify and debug your DisplayPort interface designs for sink and source ICs, motherboard systems, computers and graphics cards. The DisplayPort electrical test software is designed for use in DisplayPort Authorized Compliance Test Houses, so you can confidently use it to execute DisplayPort electrical checklist tests as well as employ it as a development tool. It displays the measurement data results in a flexible report format, and the report also provides a margin analysis that shows how closely your device passed or failed each test.

To make measurements with the U7232A DisplayPort electrical test software, you may also need the W2641A DisplayPort TPA fixture for signal access.

The U7232A DisplayPort electrical test software performs a wide range of tests required to meet the DisplayPort electrical specifications for various computer system components (sink and source ICs, motherboard systems, computers and graphics cards) as documented in section 3.5.2 and 3.5.3 of the base DisplayPort specification by VESA[1]. To introduce a DisplayPort product to the market, your product must successfully pass compliance testing based on the DisplayPort specification at an approved DisplayPort test center, and you will want to have performed the tests included on the checklist before you submit your product for full compliance testing for ultimate confidence and lowest turnaround time and process cost. The U7232A software makes it easier for you to prepare for passing the certification hurdle for DisplayPort CTS1.1.

1 Video Electronics Standards Association (**www.vesa.org**)

Agilent Technologies

U7232A saves you time

Features

The U7232A HDMI electrical test software offers several features to simplify the validation of DisplayPort designs:

- Full physical layer testing
- Verification of link layer physical layer control
- Three modes of physical layer test
- Test status tracking
- Measurement process configurability
- Automated scope measurement setup
- Test results reports with pass/fail margin analysis

With the DisplayPort electrical test software, you can use the same oscilloscope you use for everyday debugging to perform automated testing and margin analysis based on the DisplayPort-specified test checklist.

The U7232A DisplayPort electrical test software saves you time by setting the stage for automatic execution of DisplayPort electrical tests. Part of the difficulty of performing electrical tests for DisplayPort is connecting the oscilloscope to the target device, configuring the instrument for measurements, executing the test procedures, understanding what to test, and then analyzing the measured results by comparing them to limits published in the specification. The DisplayPort electrical test software does almost all of this work for you. In addition, if you discover a problem with your device, debug tools are available to aid in root-cause analysis.

The U7232A DisplayPort electrical test software offers the electrical tests for the source as well as important tests for cable and receiver tolerance testing. The software automatically configures the oscilloscope for each test, and it provides an informative results report that includes margin analysis indicating how close your product is to passing or failing that specification. Clock recovery of each lane is accomplished according to the standard by the oscilloscope using proprietary software techniques. See Table 2 for a complete list of the measurements made by the DisplayPort electrical test software.

Easy test definition

The U7232A DisplayPort electrical test software extends the ease-of-use advantages of Agilent's Infiniium Series oscilloscopes to testing DisplayPort designs. The Agilent automated test engine walks you quickly through the steps required to define the device under test, to select the tests, set up the tests, perform the tests, and view the test results. You can pick high-level test parameters to suit your test process objectives, and then you can proceed to select a category of tests all at once, or specify individual tests. The user interface is oriented to minimize reconnections, which saves you time and minimizes potential for operator error. You can save tests and configurations as project files and recall them later for quick testing and review of previous test results. Straightforward menus let you perform tests with a minimum of mouse clicks.

Test environment setup and test selection

The U7232A now allows you to define the DUT capability and select test environment variables to better suit your testing goals for speed and cost. The setup process begins with the Setup entry screen (shown in Figure 1). This screen enables selection between standard DisplayPort physical layer testing and link layer physical state change validation process. When you have selected the testing you want to perform, the setup continues as shown in Figure 2 with the 'Start project' screen where the project information, device specifics and testing template can be chosen. The template allows subsequent setup fields to have specific default values you have selected.

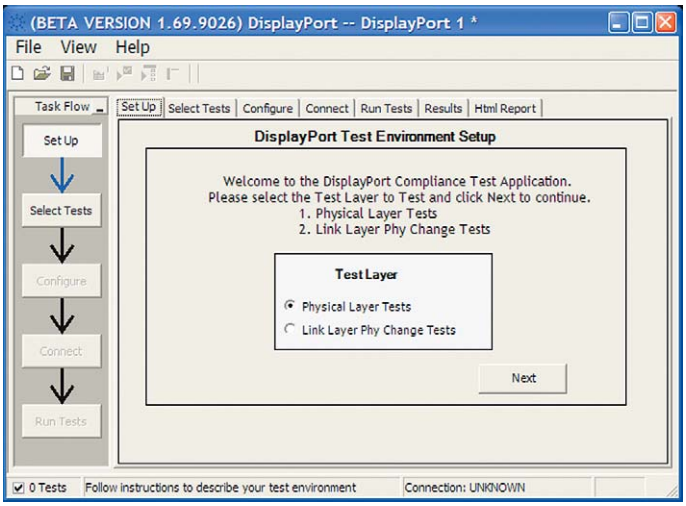


Figure 1. U7232A DisplayPort test environment setup

Since there is a wide range of setup configurations allowed for the test bench and because DisplayPort devices have a wide range of optional performance, the U7232A setup screens enable you to specify this information.

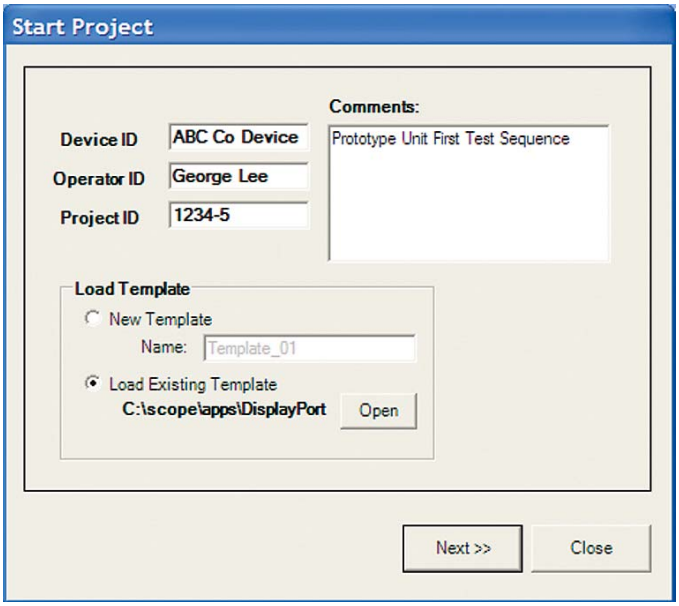


Figure 2. Configuration template to enable quick selection of common settings

Test environment setup and test selection (continued)

The U7232A software guides you through selecting important test process information. These are briefly described below.

- Device ID: enter the device name and other pertinent information.
- Operator ID: for compliance test houses to identify the operator for QA process.
- Project ID: for compliance test houses that identify projects by number, this enables the report to carry a key identification number to a contract.
- Device type: allows you to select between cable test, sink test and source test suite.
- Test type: define whether tests will be single-ended or differential, see Figure 3.
- Test mode: select between compliance conditions and user-specified modes.
- DUT definition: select the capabilities of the DUT you wish to test, see Figure 4.
- Test fixture selection: select the test fixture used, see Figure 5.
- Connection type: single-ended versus differential connection: choose between using two channels of the scope to make a differential measurement using an 'A minus B' technique or by using a differential probe on each scope channel for each lane, see Figure 5.
- Number of channels: you may choose to test a 1, 2, 4 channel connection, see Figure 4. (Note: differential connection allows full lane selection, while single-ended can only support testing 1 or 2 lanes.), see Figure 5.
- Oscilloscope connection: this screen allows you to assign oscilloscope channels and device lanes to test, see Figure 8.

For convenience, these parameters can be saved in a template file. In order to execute your planned testing, the test software needs to know what you want to test and how you want to test. For instance, you have a source device and want to test the differential tests in compliance mode. This information is conveyed to the user and easily selected in the test process setup screen as shown in Figure 3.

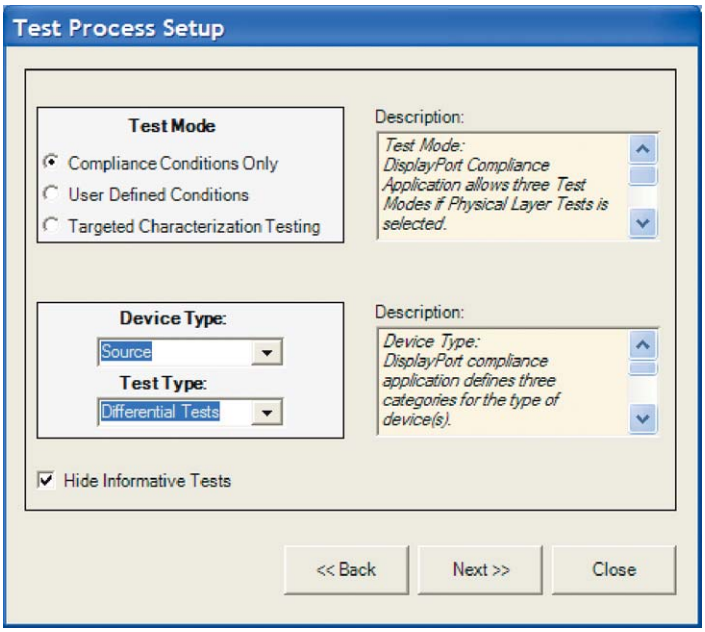


Figure 3. U7232A Test process setup screen: select test objectives and device and test type

Test mode selection

The U7232A allows you to select a test mode that suits your goals. The selection offers the choice of compliance testing, user-defined testing and targeted characterization.

The `Compliance conditions only' mode is a test process that is controlled by a configuration control that is in accordance with the DisplayPort compliance test specification. This assures the user that measurements will only be performed on those configurations required to be tested. For instance, the data eye only need be measured for 800 mVolt setting, at both bit rates, with no pre-emphasis; only those conditions will be used for eye measurement in the `compliance conditions only' mode.

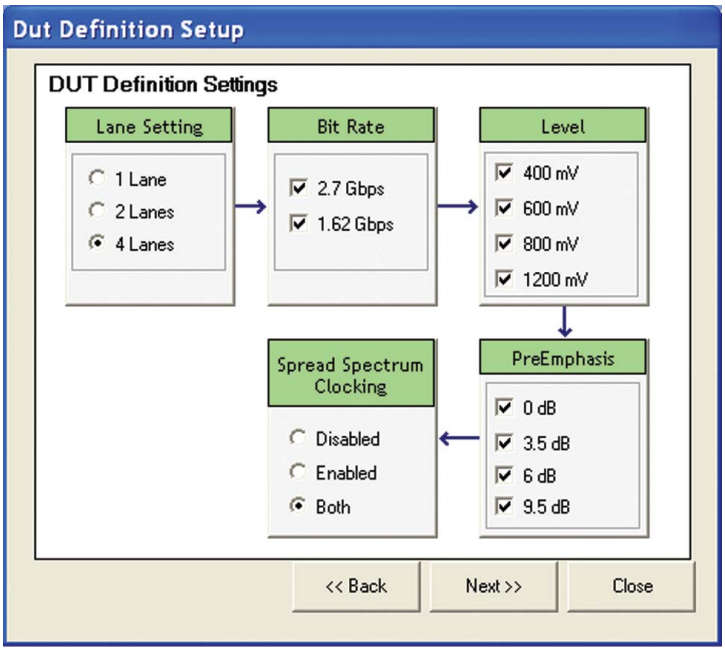


Figure 4. U7232A DUT definition entry in setup

Device definition
Critical information to guide the test process will be the device capability information. This is information about the test device such as the valid levels, pre-emphasis settings, number of lanes, bit rates and whether spread spectrum clocking is enabled or not. These capabilities are identified in the DUT definition screen in Figure 4.

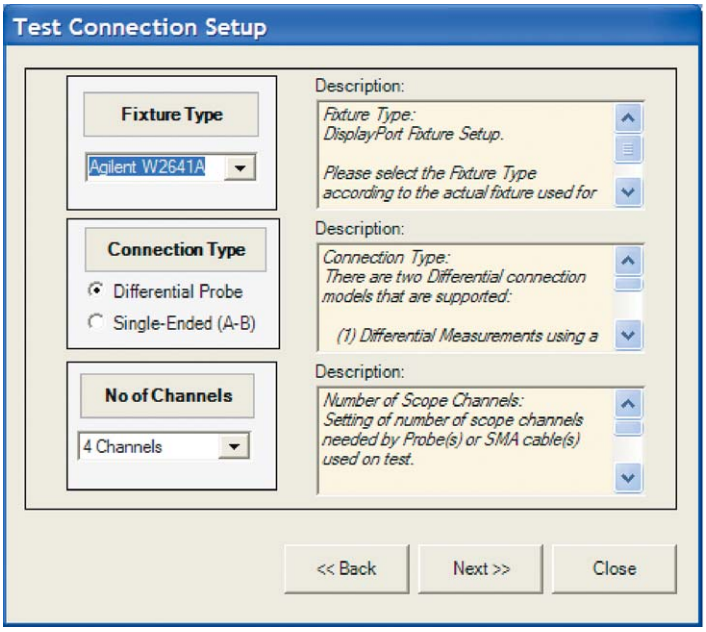


Figure 5. U7232A Test connection setup screen

Test mode selection (continued)

For user-defined testing, a similar configuration control as in 'Compliance conditions only' mode exists, however, the user is allowed to configure it by an additional menu called 'Manage test plans' (Figures 6 and 7.) Note the test setting checkmarks in Figure 7 indicating permutations to be tested. Note that this allows settings not formally allowed in the specification (800 mVolts with 6 dB pre-emphasis for example). The `Compliance conditions only' mode would not allow this.

The "Targeted characterization" mode is the standard mode (from version 1.0) which allows you to focus on specific device setup and specifically test that condition. This is useful for repeatability studies, troubleshooting and characterization.

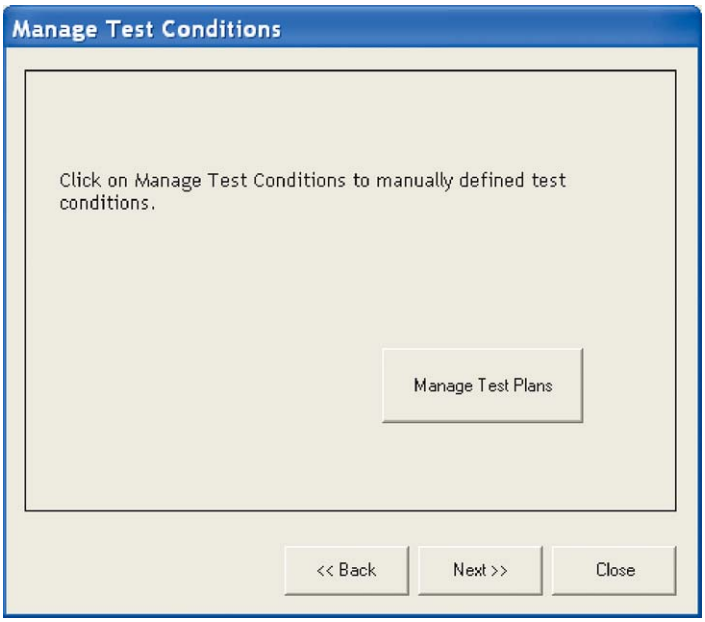


Figure 6. U7232A user defined mode enables test plans

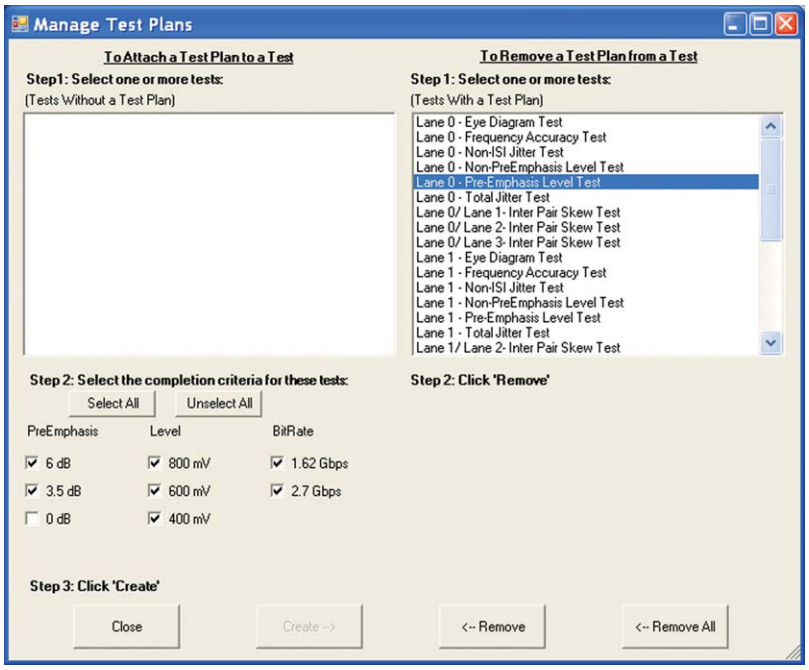

Manage Test Plans
To Attach a Test Plan to a Test
Step1: Select one or more tests:
(Tests Without a Test Plan)
To Remove a Test Plan from a Test
Step 1: Select one or more tests:
(Tests With a Test Plan)
Lane 0 - Eye Diagram Test
Lane 0 - Frequency Accuracy Test
Lane 0 - Non-ISI Jitter Test
Lane 0 - Non-PreEmphasis Level Test
Lane 0 - Pre-Emphasis Level Test
Lane 0 - Total Jitter Test
Lane 0/ Lane 1- Inter Pair Skew Test
Lane 0/ Lane 2- Inter Pair Skew Test
Lane 0/ Lane 3- Inter Pair Skew Test
Lane 1 - Eye Diagram Test
Lane 1 - Frequency Accuracy Test
Lane 1 - Non-ISI Jitter Test
Lane 1 - Non-PreEmphasis Level Test
Lane 1 - Pre-Emphasis Level Test
Lane 1 - Total Jitter Test
Lane 1/ Lane 2- Inter Pair Skew Test
Step 2: Select the completion criteria for these tests:
Select All
Unselect All
PreEmphasis
Level
BitRate
6 dB
3.5 dB
0 dB
800 mV
600 mV
400 mV
1.62 Gbps
2.7 Gbps
Step 2: Click 'Remove'
Step 3: Click 'Create'
Close
Create -->
<-- Remove
<-- Remove All

Figure 7. U7232A test plan management

Test mode selection (continued)

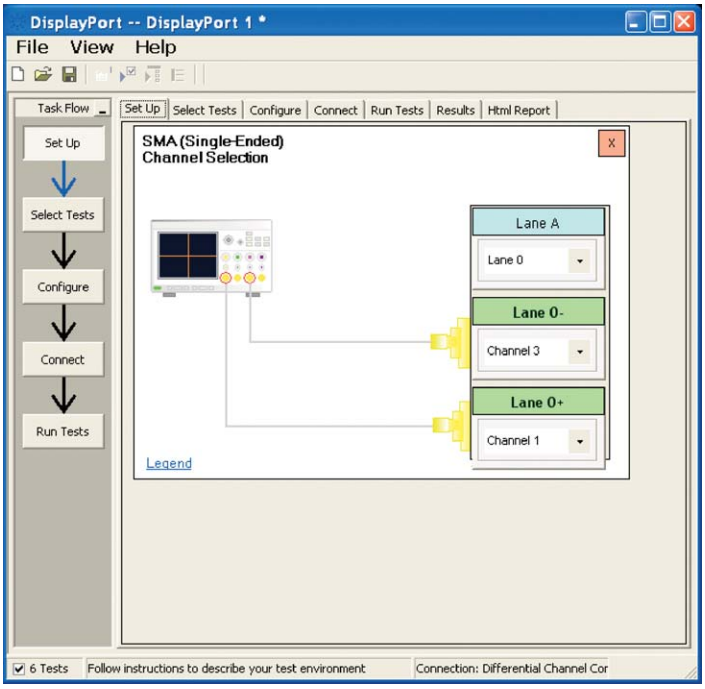


Figure 8. Test environment setup: lane and oscilloscope assignment screen

Test selection

After defining the test environment you are presented with only those tests that are appropriate for the environment chosen. For instance, if spread spectrum clocking (SSC), is not enabled then no SSC tests will appear. This is the case for pre-emphasis as well. If your device definition is one lane only, or your defined device connection is one lane (one differential probe or two single-ended connections) then no inter-pair skew tests will appear in the test suite. This dynamic filtering simplifies your job by ensuring you attempt to test only what is possible for the DUT and the connection model you have chosen.

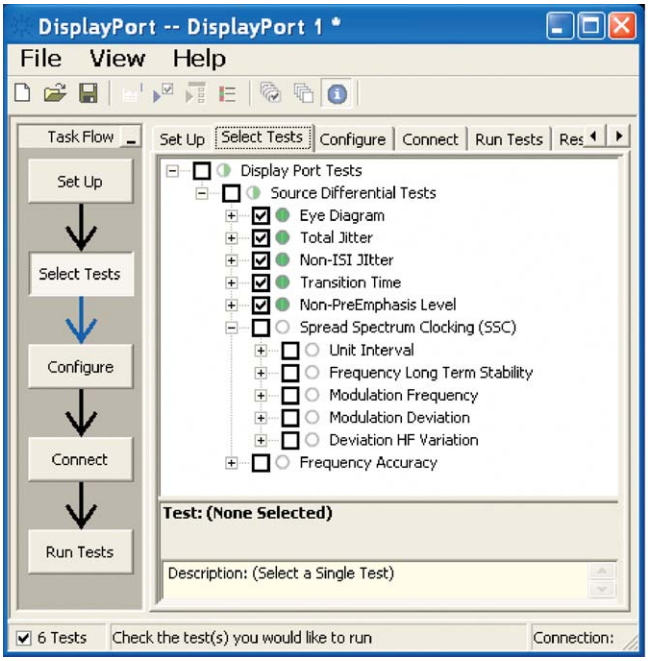


Figure 9. The Agilent automated test framework guides you quickly through selecting tests and configuring tests, setting up the connection, running the tests, and viewing the results. You can easily select individual tests or groups of tests with a mouse-click. You also can easily see the test status for the device under test.

Configurability and guided connections

The U7232A DisplayPort electrical test software provides flexibility in your test setup. It guides you to make connection changes with hookup diagrams when the tests you select require it. For test parameters such as bandwidth reduction or data channel selection, you can select appropriate values. For more critical parameters, such as mask scaling option or number of edges for analysis, default values are tied to the compliance standard; these values can only be altered in the debug screen. In Figure 10 you can see the selection for various U7232A eye mask test functions. The default for compliance mode is "Fixed" which places the mask in the center of the eye per the DisplayPort compliance test specification (shown is 'Find Margin' which will find the range of passing condition).

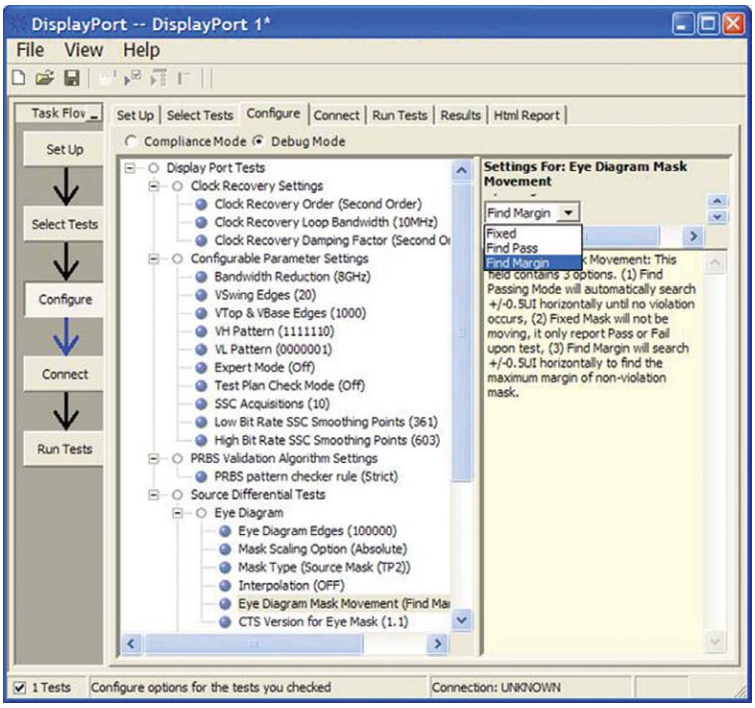

DisplayPort -- DisplayPort 1*
File View Help
Task Flow
Set Up
Select Tests
Configure
Connect
Run Tests
Results
Html Report
Compliance Mode
Debug Mode
Display Port Tests
Clock Recovery Settings
Clock Recovery Order (Second Order)
Clock Recovery Loop Bandwidth (10MHz)
Clock Recovery Damping Factor (Second Or
Configurable Parameter Settings
Bandwidth Reduction (8GHz)
VSwing Edges (20)
VTop & VBase Edges (1000)
VH Pattern (1111110)
VL Pattern (0000001)
Expert Mode (Off)
Test Plan Check Mode (Off)
SSC Acquisitions (10)
Low Bit Rate SSC Smoothing Points (361)
High Bit Rate SSC Smoothing Points (603)
PRBS Validation Algorithm Settings
PRBS pattern checker rule (Strict)
Source Differential Tests
Eye Diagram
Eye Diagram Edges (100000)
Mask Scaling Option (Absolute)
Mask Type (Source Mask (TP2))
Interpolation (OFF)
Eye Diagram Mask Movement (Find Ma
CTS Version for Eye Mask (1.1)
Settings For: Eye Diagram Mask Movement
Find Margin
Fixed
Find Pass
Find Margin
Movement: This field contains 3 options. (1) Find Passing Mode will automatically search +/-0.5UI horizontally until no violation occurs, (2) Fixed Mask will not be moving, it only report Pass or Fail upon test, (3) Find Margin will search +/-0.5UI horizontally to find the maximum margin of non-violation mask.
1 Tests
Configure options for the tests you checked
Connection: UNKNOWN

Figure 10. The U7232A configuration screen allows you to alter "soft" parameters for testing to assist in characterization and debug activities.

After you configure the test to meet your needs, the U7232A user interface displays the connection screen, which is specific to the configuration data you have selected. Figure 11 illustrates the typical connection guidance provided for differential tests for a single lane with an "A minus B" connection type.

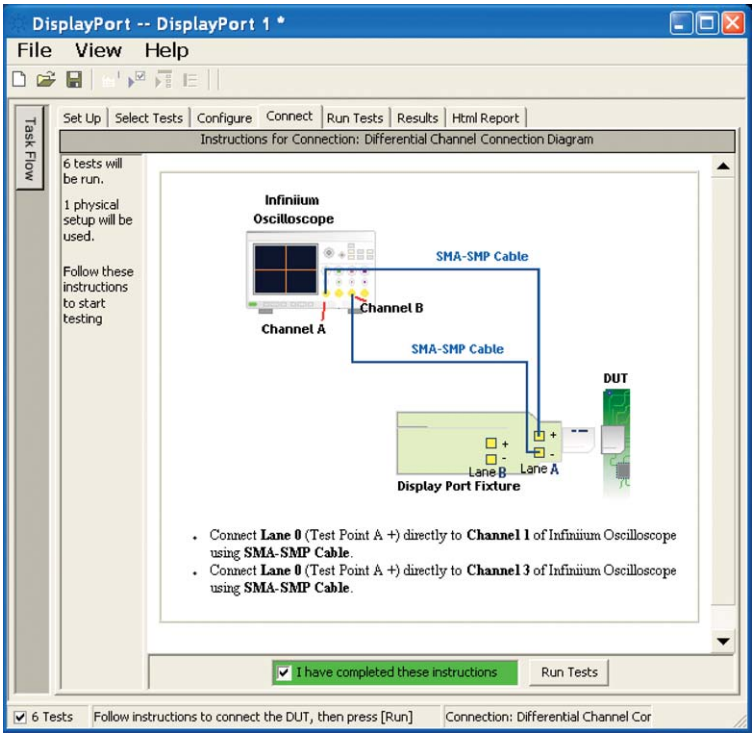

DisplayPort -- DisplayPort 1 *
File View Help
Task Flow
Set Up
Select Tests
Configure
Connect
Run Tests
Results
Html Report
Instructions for Connection: Differential Channel Connection Diagram
6 tests will be run.
1 physical setup will be used.
Follow these instructions to start testing
Infiniium Oscilloscope
SMA-SMP Cable
Channel B
Channel A
SMA-SMP Cable
DUT
Lane B
Lane A
Display Port Fixture
Connect Lane 0 (Test Point A +) directly to Channel 1 of Infiniium Oscilloscope using SMA-SMP Cable.
Connect Lane 0 (Test Point A +) directly to Channel 3 of Infiniium Oscilloscope using SMA-SMP Cable.
I have completed these instructions
Run Tests
6 Tests
Follow instructions to connect the DUT, then press [Run]
Connection: Differential Channel Cor

Figure 11. The final step before test is to illustrate the anticipated connection for the test.

Margin analysis

In addition to providing you with measurement results, the U7232A DisplayPort electrical test software provides a report format that shows you not only where your product passes or fails, but also reports how close you are to the limits specified for a particular test assertion. You select the margin test report parameter, which means you can specify the level at which warnings are issued to alert you to the electrical tests where your product is operating close to the official test limit defined by the DisplayPort compliance test specification for a given test assertion.

Eye margin: Another method of evaluating the eye is provided by sweeping the eye horizontally with the specified mask and determining the last locations on the left and right portions of the interior eye where there are no violations in the mask. The distance from the center mask location is a measure of design margin and is reported as eye margin if that eye mask mode is chosen in the configuration screen (Eye Diagram Mask Movement: Find Margin – see Figure 10 for example.)

Margin is calculated:

Single-sided specification:

$$\text{Margin} = (\text{Value}_{\text{Specification}} - \text{Value}_{\text{actual}})/\text{Value}_{\text{Specification}}$$

Double-sided specification:

$$\text{Margin} = \text{lowest of: } (\text{Value}_{\text{Specification\_High}} - \text{Value}_{\text{actual}})/\text{Range}_{\text{Specification}}$$

$$\text{and } (\text{Value}_{\text{Specification\_Low}} - \text{Value}_{\text{actual}})/\text{Range}_{\text{Specification}}$$

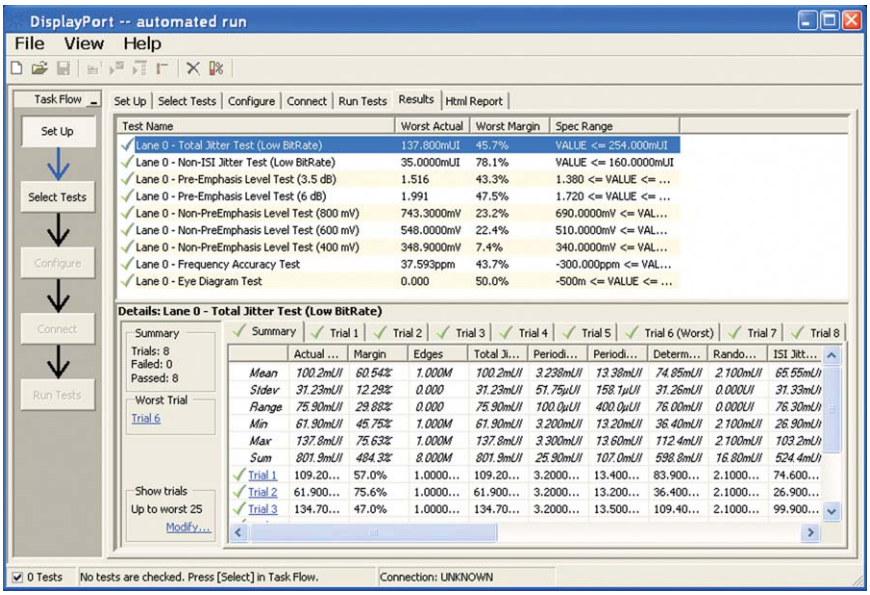
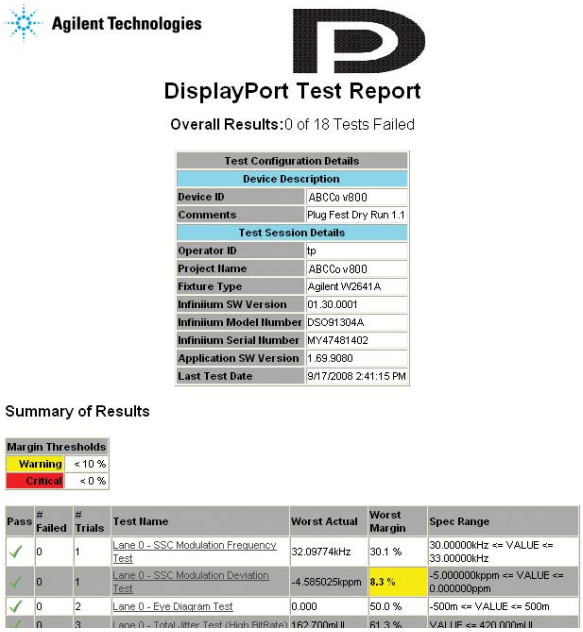

DisplayPort -- automated run
File View Help
Task Flow
Set Up
Select Tests
Configure
Connect
Run Tests
Set Up | Select Tests | Configure | Connect | Run Tests | Results | Html Report
Test Name | Worst Actual | Worst Margin | Spec Range
Lane 0 - Total Jitter Test (Low BitRate) 137.800mUI 45.7% VALUE <= 254.000mUI
Lane 0 - Non-ISI Jitter Test (Low BitRate) 35.0000mUI 78.1% VALUE <= 160.0000mUI
Lane 0 - Pre-Emphasis Level Test (3.5 dB) 1.516 43.3% 1.380 <= VALUE <= ...
Lane 0 - Pre-Emphasis Level Test (6 dB) 1.991 47.5% 1.720 <= VALUE <= ...
Lane 0 - Non-PreEmphasis Level Test (800 mV) 743.3000mV 23.2% 690.0000mV <= VAL...
Lane 0 - Non-PreEmphasis Level Test (600 mV) 548.0000mV 22.4% 510.0000mV <= VAL...
Lane 0 - Non-PreEmphasis Level Test (400 mV) 348.9000mV 7.4% 340.0000mV <= VAL...
Lane 0 - Frequency Accuracy Test 37.593ppm 43.7% -300.000ppm <= VAL...
Lane 0 - Eye Diagram Test 0.000 50.0% -500m <= VALUE <= ...
Details: Lane 0 - Total Jitter Test (Low BitRate)
Summary
Trials: 8
Failed: 0
Passed: 8
Worst Trial
Trial 6
Show trials
Up to worst 25
Modify...
Summary | Trial 1 | Trial 2 | Trial 3 | Trial 4 | Trial 5 | Trial 6 (Worst) | Trial 7 | Trial 8
Actual ... | Margin | Edges | Total Ji... | Periodi... | Periodi... | Determ... | Rando... | ISI Jitt...
Mean 100.2mUI 60.54% 1.000M 100.2mUI 3.238mUI 13.38mUI 74.85mUI 2.100mUI 65.55mUI
Stdev 31.23mUI 12.28% 0.000 31.23mUI 51.75µUI 158.1µUI 31.26mUI 0.000UI 31.33mUI
Range 75.90mUI 29.88% 0.000 75.90mUI 100.0µUI 400.0µUI 76.00mUI 0.000UI 76.30mUI
Min 61.90mUI 45.75% 1.000M 61.90mUI 3.200mUI 13.20mUI 36.40mUI 2.100mUI 26.90mUI
Max 137.8mUI 75.63% 1.000M 137.8mUI 3.300mUI 13.60mUI 112.4mUI 2.100mUI 103.2mUI
Sum 801.3mUI 484.3% 8.000M 801.9mUI 25.90mUI 107.0mUI 598.8mUI 16.80mUI 524.4mUI
Trial 1 109.20... 57.0% 1.0000... 109.20... 3.2000... 13.400... 83.900... 2.1000... 74.600...
Trial 2 61.900... 75.6% 1.0000... 61.900... 3.2000... 13.200... 36.400... 2.1000... 26.900...
Trial 3 134.70... 47.0% 1.0000... 134.70... 3.2000... 13.500... 109.40... 2.1000... 99.900...
0 Tests
No tests are checked. Press [Select] in Task Flow.
Connection: UNKNOWN

Figure 12. The DisplayPort electrical test software results report documents your test, indicates the pass/fail status, the test specification range, the measured values, and the margin.

Thorough performance reporting

The U7232A DisplayPort compliance and validation software generates thorough reports that not only capture the performance and status of the device under test, but also the screen shots of your most significant measurements for your perusal and evaluation. The first page of the report lists equipment and configuration details required in standard quality assurance programs. It also provides a hot-linked results table that will quickly get you to the measurement report section of interest.



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DisplayPort Test Report

Overall Results: 0 of 18 Tests Failed

Test Configuration Details	
Device Description	
Device ID	ABCCo v800
Comments	Plug Fest Dry Run 1.1
Test Session Details	
Operator ID	tp
Project Name	ABCCo v800
Fixture Type	Agilent W2641A
Infiniium SW Version	01.30.0001
Infiniium Model Number	DSO91304A
Infiniium Serial Number	MY47481402
Application SW Version	1.69.9080
Last Test Date	9/17/2008 2:41:15 PM

Summary of Results

Margin Thresholds	
Warning	< 10 %
Critical	< 0 %

Pass	# Failed	# Trials	Test Name	Worst Actual	Worst Margin	Spec Range
✓	0	1	Lane 0 - SSC Modulation Frequency Test	32.09774kHz	30.1 %	30.00000kHz <= VALUE <= 33.00000kHz
✓	0	1	Lane 0 - SSC Modulation Deviation Test	-4.585025kppm	8.3 %	-5.000000kppm <= VALUE <= 0.000000ppm
✓	0	2	Lane 0 - Eye Diagram Test	0.000	50.0 %	-500m <= VALUE <= 500m
✓	0	3	Lane 0 - Total Jitter Test (High BitRate)	162.700mUI	61.3 %	VALUE <= 420.000mUI

Figure 13. The U7232A software generates a summary report where you can see the total test results for your device quickly and clearly. Additional details are available for each test, including the test limits, test description, and test results, including waveforms, if appropriate. In addition, the margin of the result is indicated to provide further insight.

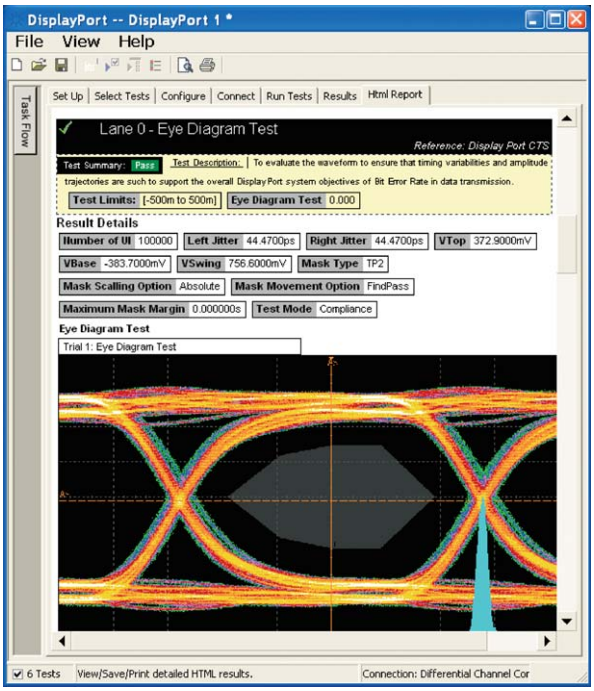
DisplayPort -- DisplayPort 1 *
File View Help
Task Flow
Set Up | Select Tests | Configure | Connect | Run Tests | Results | Html Report
Lane 0 - Eye Diagram Test
Reference: Display Port CTS
Test Summary: Pass
Test Description:
To evaluate the waveform to ensure that timing variabilities and amplitude trajectories are such to support the overall DisplayPort system objectives of Bit Error Rate in data transmission.
Test Limits: [-500m to 500m]
Eye Diagram Test 0.000
Result Details
Number of UI 100000
Left Jitter 44.4700ps
Right Jitter 44.4700ps
VTop 372.9000mV
VBase -383.7000mV
VSwing 756.6000mV
Mask Type TP2
Mask Scaling Option Absolute
Mask Movement Option FindPass
Maximum Mask Margin 0.000000s
Test Mode Compliance
Eye Diagram Test
Trial 1: Eye Diagram Test
6 Tests
View/Save/Print detailed HTML results.
Connection: Differential Channel Cor

Figure 14. Summary report detail: The U7232A software's summary report provides screen shots of all the measurements that have been performed. In this figure you can see the data-eye. Observe the clear status and description at the top and the measurement data just above the eye.

Test status tracking

The U7232A software can keep track of the status in a test plan either for `Compliance conditions only' or `User defined conditions' modes and is visually viewable in the Test run menu (Figures 15 and 16). In addition, you can choose to resume testing the device and the software where it stopped the time before.

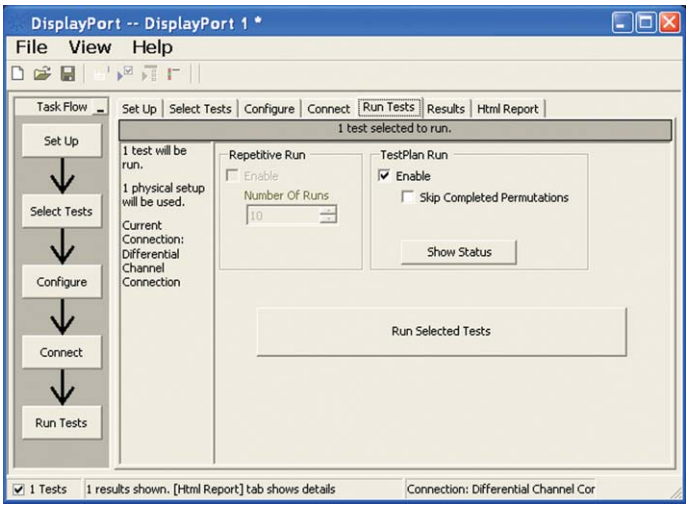

Figure 15. Show test status: test status selected in the 'Run tests' menu

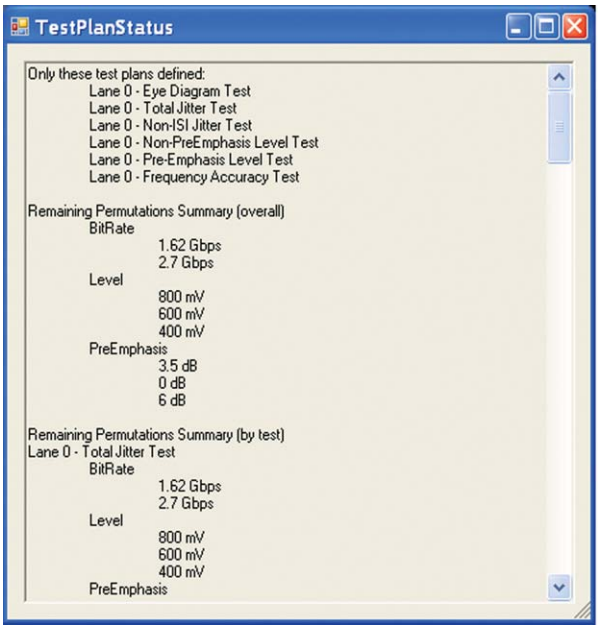

Figure 16. Test status tracking: when all tests are complete there are no entries below 'Remaining permutations summary'

Cable equalization feature

The U7232A software leverages the equalization algorithms that were implemented in HDMI. Though not required in DisplayPort, these algorithms can assist in the design of receiver equalization methods by comparing against a reference model of equalization. Equalization models exist for Cat 2 cable for 2, 5, and 10 meters, assuming standard models of skin loss. Your own custom models are possible using the "User-Specified" equalization mode. Figure 17 illustrates the performance of a non-equalized DisplayPort cable versus equalization for a 5-meter cable.

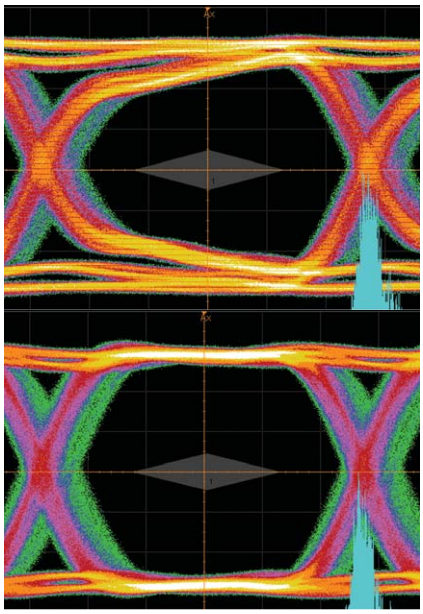

Figure 17. Cable equalization model for receiver eye or cable analysis. Top: no equalization. Bottom: 5-meter equalization model applied.

W2621A DisplayPort test point adapter

Figure 18. The Agilent W2641A DisplayPort test point adapter fixture

The W2641A DisplayPort TPA test fixture simplifies the measurement process by providing access to the electrical measurement points required for compliance tests. It breaks out the DisplayPort data lanes to pairs of SMP connectors for high-bandwidth probing with either direct connection to scope channels, or to InfiniiMax SMA differential probes through short SMP-to-SMA cables. Of course, single-ended measurements are supported as well. To support DisplayPort AUX channel for device control, two SMP connectors and a digital connector allow for direct connection to the AUX channel lane.

Measurement requirements

To use the U7232A electrical performance validation and compliance software with the Agilent W2641A DisplayPort TPA fixture, you will need at least one pair of the four SMP to SMA cable pairs provided. Use of differential probe amplifiers (1134A, 1168A, or 1169A) and appropriate SMA probe heads (N5380A) is optional. However, if you want connection simplicity, consider these probes for one-time setup and complete characterization for all differential measurements. If you are not using the W2641A test fixture, you will need to select the appropriate probe head to interface with your fixture. For instance, if the high speed signals are only accessible through a terminated 50-ohm transmission line (for testing silicon devices for example), you will need to use the E2678A socketed probe head, the E2677A, or N5381A solder-in differential probe head for high impedance probing and select these in the scope channel setup menu.

You can minimize test time by using four InfiniiMax probes to measure all four main link differential data lanes (Lane0, Lane1, Lane2, Lane3) without having to reposition or reconnect probes. To use this capability, select Connection Type: Differential Probe, Number of Channels: Four Channels in the Setup screen.

Oscilloscope compatibility

The U7232A DisplayPort electrical performance validation and compliance software is compatible with Agilent X90000 Series oscilloscopes with operating software revision 2.50 or higher, 90000 Series oscilloscopes with operating software revision 1.1 or higher or the Agilent 80000 Series oscilloscopes with operating software revision A.05.40 or higher (Windows® XP Pro). For oscilloscopes with earlier software revisions, free upgrade software is available at **http://www.agilent.com/find/infiniium_software**.

Table 1. Recommended oscilloscopes and bandwidth for the DisplayPort 1.1 specification

Agilent oscilloscopes for DisplayPort compliance test*

Suitable oscilloscopes	Recommended new purchase	Oscilloscope bandwidth
DSO80804A/B	DSO90804A or DSA90804A††	8 GHz*
DSO81004A/B		10 GHz†
DSO812004A/B	DSO91204A or DSA91204A	12 GHz†
DSO813004A/B	DSO91304A or DSA91304A	13 GHz†
DSO/DSAX91604A		16 GHz
DSO/DSAX92004A		20 GHz
DSO/DSAX92504A		25 GHz
DSO/DSAX92804A		28 GHz
DSO/DSAX93204A		32 GHz

* 8 GHz Bandwidth is recommended by the DisplayPort Compliance Test Specification.

† The U7232A software will automatically control the bandwidth setting of the oscilloscope if the N5403A noise reduction software is enabled.

†† The DSO80000 and DSO90000 Series oscilloscopes are upgradable in bandwidth from 2 to 13 GHz. DSA models come with jitter and serial data analysis packages.

††† The Infiniium 90000 X-Series oscilloscopes are upgradeable in bandwidth from 16 to 32 GHz

Tests performed

The U7232A DisplayPort electrical performance validation and compliance software performs all the required tests and many of the informative ones as listed in the DisplayPort Compliance Test Specification 1.1 (CTS1.1) as documented in section 3.5.3 of the base specification.

Note that the U7232A DisplayPort test software can make other measurements not included here, such as receiver eye measurements and equalized eye measurements as well as most of the newly omitted CTS 1.1 measurements.

Table 2. DisplayPort electrical tests performed by the U7232A software

Assertion number	Test description	Compliance status	Included with U7232A
Section 3			
Test ID 3.1	Data eye diagram	Normative	Yes
Test ID 3.2	Non pre-emphasis level verification	Normative	Yes
Test ID 3.3	Pre-emphasis level verification	Normative	Yes
Test ID 3.4	Inter-pair skew	Normative	Yes
Test ID 3.5	Intra-pair skew	Normative	Yes
Test ID 3.6	Differential transition time	Omitted*	Yes
Test ID 3.7	Single-ended rise and fall mismatch	Omitted*	Yes
Test ID 3.8	Overshoot and undershoot	Omitted*	No
Test ID 3.9	Frequency accuracy	Omitted*	No
Test ID 3.10	AC common mode noise	Normative	Yes
Test ID 3.11	Non-ISI jitter measurements	Normative	Yes
Test ID 3.12	Total jitter measurements	Normative	Yes
Test ID 3.13	Unit interval	Omitted*	Yes
Test ID 3.14	Main link frequency compliance	Omitted*	Yes
Test ID 3.15	Spread spectrum modulation frequency	Normative	Yes
Test ID 3.16	Spread spectrum modulation deviation	Normative	Yes
Test ID 3.17	Spread spectrum dF/dt	Informative	No

* These tests were defined for DisplayPort CTS 1.0 and were informative. They have been deleted for DisplayPort CTS 1.1

Ordering information

To purchase the U7232A DisplayPort source compliance test software with a new or existing Infiniium 90000 or 90000 X-Series oscilloscope, order the following:

Model number	Description	Quantity
DSO90804A	Oscilloscope (see Table 1)	1
Option 003	High-speed serial data analysis software	1
Option 004	EZJit Plus jitter analysis software	1
1168A/1169A	10/12-GHz probe amplifiers. 1169A recommended.	4 (optional)
N5380A	12-GHz SMA probe heads for differential and single-ended measurements	4 (optional)
U7232A or DSO90000-028	DisplayPort test compliance software for Infiniium Series oscilloscopes	1
DSOX90000-028	Oscilloscope	1
N2800A	Probe amplifiers	4 (optional)
N5444A	Probe head	4 (optional)

or you can order an adapter, N5442A with the 1168/1169 amplifiers and N5380A

For physical connection to a DisplayPort device to perform tests with the U7232A DisplayPort compliance test software, order the following:

Model number	Description	Quantity
W2641A	DisplayPort test point access adapter (plug)	1
Standard connection		
N4235-61602	SMP to SMA cables (replacement cables)	As needed
For right angle connection (optional)		
N5460A	SMP to SMA cables right angle connector	1, 2 or 4 pairs
E4809-23801	Cable plug-in tool (recommended)	1
E4809-23802	Cable removal tool (required for right angle cables)	1
Bit-DP-RTF-0001 (BitifEye Corp).	DisplayPort receptacle test point adapter (optional) used in cable test or system calibration	1 or 2

Measurement and test accessories

To complete your test setup, Agilent provides a wide range of cables, adapters, terminations, etc.

Model number	Description
11667B	Power splitter, DC to 26.5 GHz, 3.5-mm (f) connectors
11636B	Power divider, DC to 26.5 GHz, 3.5-mm (f) connectors
8493B	Coaxial attenuator (3, 6, 10, 20 or 30 dB), DC to 18 GHz, SMA connector
1250-1158	SMA (f - f) adapter, DC to 18 GHz
1250-1159	SMA (m - m) adapter, DC to 18 GHz
1250-1397	Right-angle adapter, SMA (m - m)
1250-1741	Right-angle adapter, SMA (f - m)
1250-1698	SMA tee adapter (m, f, f), DC to 12.4 GHz
1250-1694	SMA (m) to SMA (f) adapter
15442A	Cable kit, four 90-cm (36-inch) SMA (m - m) cables
15443A	Matched cable pair, two 90-cm (36-inch) SMA (m - m) cables, propagation delay within 25 ps
1810-0118	SMA (m) 50 Ω termination
33SMA-Q50-0-4	SMA push-on adapters from S.M. Electronics (or equivalent)

Related literature

Publication title	Publication type	Publication number
Infiniium DSO90000 and DSA90000 Series Oscilloscopes	Data sheet	5989-7819EN
N5394A DVI Electrical Performance Validation and Compliance Software	Data sheet	5989-1526EN
N5399A HDMI Electrical Performance Validation and Compliance Software	Data sheet	5989-5118EN
N5990 Automation Software	Data sheet	5989-5483EN
W2641A DisplayPort Test Point Access Adapter	Data sheet	5989-7274EN

Product Web site

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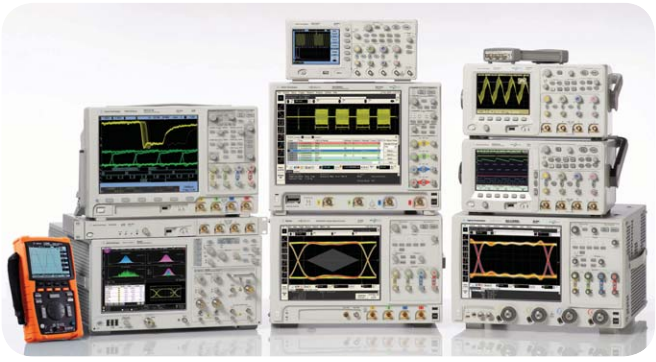

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